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Flowers and insects. IV.

CHARLES ROBERTSON.

Baptisia leucantha Torr. & Gr.—The flowers are arranged in long, loose, erect racemes, and are white, except a broad purple streak on the base of the banner, which forms a nectar-guide. The stamens are distinct, and bees insert their proboscides between the filaments of the upper ones. The anthers dehisce in succession. Accordingly bees visit each flower several times to gather the pollen. After the wings and keel have been depressed by an insect resting upon them, they promptly return to their former position, concealing the stamens and pistil.

The calyx is from 8 to 9 mm. deep, which alone would restrict the visitors to the longest tongues. The calyx further tends to exclude short tongues by clasping the petals and holding them so that they are not easily forced apart. Then the banner is strengthened by three longitudinal folds —a median one where it clasps the wing and keel petals, and two lateral ones formed by the lobes being reflexed upon the central portion. The banner thus forcibly resists any upward pressure. On account of the depth of the calyx and the large size and rigidity of the petals, only the largest and strongest bees can force their way in. The flowers are visited very abundantly for honey and pollen by *Bombus americanorum* F. ♀. I know of no other flower in my neighborhood which seems to depend so exclusively on a single species of humble bee. Once I saw a butterfly, *Callidryas eubule* L., thrusting its proboscis under the banner, but, although it could reach the nectar, it would be by no means certain to touch the anthers or stigma.

Psoralea Onobrychis Nutt.[1]—The plants grow in large patches and bear many racemes of blue flowers, which are very attractive to bees. Greenish lines on the banner form path-finders. The wings and keel are depressed together, and return so as to cover the stamens. The stigma is raised considerably above the anthers and so strikes the bee in ad-

[1]On this species see Fuerste: BOT. GAZ., XIII, 152.

vance of them. The calyx tube is about two mm. deep, so that small bees which know how to force their way into the flower can reach the nectar. The flowers are sought by many insects, especially bees of the genus Megachile.

Visitors (7 days, June 26–July 11): Hymenoptera—*Apidæ*: (1) *Apis mellifica* L. ☿, s.; (2) *Ceratina dupla* Say ♀, s.; (3) Megachile sp. ♂ ♀, s. and c. p.; (4) *M. addenda* Cr. ♂, s.; (5) *M. mendica* Cr. ♀, s. and c. p., ab.; (6) *M. brevis* Say ♂ ♀, s. and c. p., ab.; (7) *M. perbrevis* Cr. ♂, s.; (8) *Anthidium emarginatum* Say ♂, s.; (9) *Alcidamea producta* Cr. ♀, s. and c. p.; (10) *Osmia distincta* Cr. ♀, s.; (11) *Cœlioxys 8-dentata* Say ♀, s.; (12) *Calliopsis andreniformis* Sm. ♂ ♀, s. and c. p., ab. *Andrenidæ*: (13) *Agapostemon radiatus* Say ♀, s. and c. p.; (14) *Halictus coriaceus* Sm. ♀, s.; (15) *H. Lerouxii* St. Farg. ♀, s.; (16) *H. flavipes* F. ♂ ♀, s.; (17) Colletes sp. ♂, s. *Eumenidæ*: (18) *Odynerus dorsalis* F., s.; (19) *O. arvensis* Sauss., s. *Sphecidæ*: (20) *Prionotyx atrata* St. Farg.; (21) *P. thomæ* F., both s.

Diptera—*Bombylidæ*: (22) *Anthrax sinuosa* Wied.; (23) *A. parvicornis* Lw., both s.

Lepidoptera—*Rhopalocera*: (24) *Papilio philenor* L.; (25) *Pieris protodice* Bd.-Lec. *Noctuidæ*: (26) *Anthœcia jagnarina* Gn., all 3 s.

Amorpha canescens Nutt.—The proterogyny of this plant and of A. fruticosa has been recorded by Beal.[2] Müller[3] has figured A. fruticosa and described its mechanism, confirming Beal's view in regard to proterogyny and adding that self-fertilization may occur in absence of insects. Meehan[4] also has observed the flowers, but while he recognized the fact that the pistil matures a day before the anthers, he holds that the flowers are self-fertilized, and that too after having observed that "the flowers seem very grateful to the pollen-gathering insects." He also considers the late enlargement of the banner as wholly superfluous, disregarding the fact that the real instrument of attraction is the whole inflorescence, and that anything which increases the conspicuousness of the spike is an advantage to all of the flowers.

Visitors (June 24–26 and 28): Hymenoptera—*Apidæ*: (1) *Bombus americanorum* F. ♀ ☿, s. and c. p.; (2) *Ceratina dupla* Say ♀, s.; (3) *Megachile brevis* Say ♀, s. and c. p.:

[2] Am. Nat. I, 405.

[3] Weitere Beobachtungen, II, 244, and Pl. II and III, figs. 52–54.

[4] Proc. Acad. Sci. Phil., 1887, 329, 330. See also Delpino: Ult. osservazioni, I, 67, 68.

(4) *Alcidamea producta* Cr. ♀, s.; (5) *Andronicus cylindricus* Cr. ♀, c. p.: (6) *Heriades carinatum* Cr. ♀, c. p.: (7) *Cœlioxys 8-dentata* Say ♀, s.: (8) *Calliopsis andreniformis* Sm. ♀, s. *Andrenidæ:* (9) Halictus sp. ♂, s.; (10) *H. pilosus* Sm. ♀, s.: (11) *H. connexus* Cr. ♀, s. and c. p.; (12) *Prosopis affinis* Sm. ♀, f. p.; (13) *P. pygmæa* Cr. ♀, f. p. *Eumenidæ:* (14) *Eumenes fraternus* Say, s. *Sphecidæ:* (15) *Ammophila intercepta* St. Farg.: (16) *A. vulgaris* Cr.; (17) *Priononyx atrata* St. Farg., all 3 s.

Diptera—*Syrphidæ:* (18) *Paragus bicolor* F.: (19) *Tropidia mamillata* Lw., both f. p.

Coleoptera—*Chrysomelidæ:* (20) *Diabrotica 12-punctata* Oliv.: (21) *D. atripennis* Say. *Meloidæ:* (22) *Macrobasis unicolor* Kby., all f. p.

Petalostemon violaceus Mx.—The plants grow in rather large patches, the stems being terminated by several close spikes of rose-purple flowers, which I regard as proterandrous. The corolla is nearly regular, and it seems as if it might as well be quite so, as far as its effect upon insects is concerned. Indeed, the calyx has more to do with determining the character of the visitors. The number of wasps is far greater than would be expected on a flower of the complicated structure we find in most Papilionaceæ. The organs are so exposed that the stigma is pollinated and the pollen is collected by bees crawling around the spikes. The nectar is not very deeply seated, the calyx being 3 to 4 mm. deep; but the flowers are visited more frequently for pollen than for nectar.

Visitors (7 days, July 5–30): Hymenoptera—*Apidæ:* (1) *Apis mellifica* L. ☿, s. and c. p.: (2) *Bombus virginicus* Oliv. ☿, s. and c. p.; (3) *B. separatus* Cr. ♂ ♀ ☿, s. and c. p.: (4) *B. americanorum* F. ♀ ☿, s. and c. p., ab.: (5) *B. scutellaris* Cr. ☿, s. and c. p.: (6) *Melissodes obliqua* Say ♂ ♀, s. and c. p.: (7) *M. bimaculata* St. Farg. ♂, s.: (8) *Ceratina dupla* Say ♀, s. and c. p.[5]: (9) *Megachile brevis* Say ♀, s. and c. p., ab.: (10) *M. inimica* Cr. ♀, s. and c. p.; (11) *Andronicus cylindricus* Cr. ♀, s. and c. p.: (12) *Cœlioxys 8-dentata* Say, s.: (13) *Epeolus remigatus* F. ♀, s.: (14) *E. lunatus* Say ♂ ♀, s., ab. *Andrenidæ:* (15) *Agapostemon nigricornis* F. ♀, s. and c. p., ab.: (16) *Augochlora pura* Say ♀, c. p.: (17) *A. lucidula* Sm. ♀, s.: (18) Halictus sp. ♀, c. p.: (19) *H.*

[5] This bee is said to be destitute of pollenigerous organs, but it certainly has a thin scopa and I have often seen it collecting pollen. In Am. Nat. XIII, 430, Prof. Trelease mentions having seen it collecting pollen of Lobelia syphilitica.

parallelus Say ♂ ♀, s. and c. p., ab.; (20) *H. flavipes* F. ♀, s. and c. p., ab.; (21) *H. pilosus* Sm. ♀, c. p.: (22) *H. connexus* Cr. ♀, c. p.; (23, 24) Colletes spp. ♀, s. and c. p. *Eumenidae:* (25) *Eumenes fraternus* Say, s. *Bembecidae:* (26) *Bembex nubilipennis* Cr. s. *Sphecidae:* (27) *Ammophila procera* Klug.: (28) *A. intercepta* St. Farg.: (29) *Sphex ichneumonea* L.; (30) *Prionotyx atrata* St. Farg.—all s. *Scoliidae:* (31) *Elis plumipes* Dru., s.

Diptera—*Sarcophagidae:* (32) Sarcophaga sp.

Lepidoptera—*Rhopalocera:* (33) *Lycaena comyntas* Godt.: (34) *Colias caesonia* Stoll: (35) *C. philodice* Godt.: (36) *Pholisora catullus* F.—all s.

Coleoptera—*Meloidae:* (37) *Epicauta pennsylvanica* De G.: (38) *E. trichrus* Pall.—both s. and f. p.

Hemiptera—*Capsidae:* (39) *Calocoris rapidus* Say, s. *Pentatomidae:* (40) *Euschistus variolaris* P. B., s.

Tephrosia Virginiana Pers.—The banner is light yellow, the wings and keel are pink. The anthers dehisce in the keel, and when the keel is depressed the pollen is carried out on a brush of hairs which covers the upper edge of the style. The stigma itself is covered with pollen at first and aids in carrying it out so as to strike the bee, but it is probably not receptive until after the pollen has been removed and its surface has been rubbed, as in the case of Anthyllis, etc.[6] The flowers are visited for honey and pollen by *Megachile brevis* Say ♀.

Desmodium.—The behavior of this flower was described by Bessey in the case of D. sessilifolium,[7] and by Foerste in D. canescens.[8] The keel incloses the stamens and pistil, and is held in position by two processes on the base of the banner. The keel has such a strong tendency to fly down that it bends the inclosed organs downward with it; the stamens and pistil, therefore, have a strong tendency to fly up. The wings also are held by the banner, and are so closely united with the keel that when one of them is released the keel is released with it. The wings thus act as triggers by which the flower is discharged; but the discharge may also be effected by raising the banner, or by forcing the banner and keel apart.

[6] See Müller, Fertilization of Flowers, 173.

[7] Am. Nat. XIX, 711–713, figs. 1–4.

[8] Bot. Gazette, XIII, 152.

The filaments are expanded at the tips and are turned outward a little, so as to form a little basket in which the pollen is received when discharged, and which aids in throwing the pollen when the trap is sprung.

Foerste says, "The fact that the tenth stamen is free is *a priori* evidence of the existence of honey." Bessey seems to have supposed that nectar was present and that the spots on the base of the banner were nectar-guides. But the stamen tube is closed below and nectar is wanting; the flower belongs with such flowers as Genista tinctoria and Sarothamnus scoparius," which are adapted to be visited only by pollen-collecting bees, and which permit only one visit.

When a bee lights upon the flower it thrusts its head under the base of the banner while with its legs it forces one or both of the wings outward and downward so as to dislodge it from the banner. This frees the keel, which snaps down violently. The column, being in turn freed from the keel, flies up and hurls the pollen against the ventral surface of the bee.

Desmodium Canadense DC.—This is the largest flowered species, and can only be exploded easily by the largest bees. Consequently, humble bees are more abundant than on any of the other species.

Visitors (July 20, Aug. 15): *Apidae*: (1) *Bombus separatus* Cr. ♂; (2) *B. americanorum* F. ♂; (3) *Melissodes bimaculata* St. Farg. ♀; (4) *Megachile brevis* Say ♀, rare, and only open the flower with difficulty.

Desmodium cuspidatum T. & G.—Visitors (Aug. 13 and 22): *Apidae:* (1) *Bombus americanorum* F. ♂; (2) *Melissodes bimaculata* St. Farg. ♀; (3) *Megachile brevis* Say ♀.

Desmodium Dillenii Darl.—Visited by *Bombus americanorum* F. ♂.

Desmodium paniculatum DC.—Visitors (4 days, Aug. 8–Sept. 10): *Apidae:* (1) *Bombus americanorum* F. ♂; (2) *Melissodes bimaculata* St. Farg. ♀; (3) *Megachile brevis* Say ♀; (4) *M. mendica* Cr. ♀; (5) *Calliopsis andreniformis* Sm. ♀.

Desmodium sessilifolium T. & G.—Visited by *Megachile brevis* Say ♀.

Desmodium Marilandicum Boott.—The small flowers of this plant are exploded by a little bee, *Calliopsis andreniformis* Sm. ♀.

We have observed that the flowers are adapted to the

[a] See Müller, Fertiliztion of Flowers.

pollen-collecting bees; so that, at the start, all male bees and all cuckoo-bees are excluded. Then the visitors must be intelligent enough to know how to snap the flowers and to keep from being frightened by their explosion. For this reason the visitors of Desmodium are the most intelligent of the genera to which they belong, or are at least more used to visiting flowers of complicated structure.

On the six species of Desmodium mentioned above there occur two species of Bombus, one of Melissodes, two of Megachile and one of Calliopsis. Of eight species of Bombus which occur in my neighborhood, B. americanorum is the most intelligent and the most important visitor of irregular flowers. This bee was seen on the flowers of four species, while B. separatus was seen only on D. Canadense. Of seven species of Melissodes, M. bimaculata is most common on irregular flowers, while the others occur more often on Compositæ. Most of twelve species of Megachile also limit their attentions to Compositæ, while M. brevis and M. mendica are common on irregular flowers. The same is true of the five species of Calliopsis, C. audreniformis being the only one observed on irregular flowers.

The larger flowered species also limit their visitors by the strength required to discharge them. Thus, D. Canadense is most abundantly visited by humble bees, since the smaller bees, like Megachile, can only snap them with difficulty. The little Calliopsis audreniformis is neither strong enough to spring the trap nor is it large enough to receive the pollen. But while the small bees are excluded from the large flowers, the large bees can easily discharge and receive the pollen of the smaller flowers. As a consequence, the smaller flowers, like D. paniculatum, are sought by a greater number of species. But the very small flowers of D. Marilandicum seem to depend exclusively upon Calliopsis.

Carlinville, Ill.

Mycologic observations. I.

A. P. MORGAN.

(*January, 1890.*)

1. The winter season can not usually be considered very favorable to the growth of fungi: nevertheless during warm and mild rainy spells many kinds will be found growing. Aside from the woody and leathery forms which are peren-

nial or remain alive till spring, I have noted this month some 25 or 30 different species.

2. Little or nothing is to be found coming up out of the ground, but on old trunks there are occasionally tufts of Agaricus sapidus, and about the roots or upon the erect, dead trunk of willows or sometimes of sugar maple may be seen the yellow tufts of Agaricus velutipes. An old dead tree in the deep woods is always a fertile subject. Look along it and underneath it. Pull off its bark, examine the inside and the wood next it. You will find Myxos, Hyphos, Pezizas, etc.

3. During the winter season flourish best many kinds of Tremellas and their kindred. Hirneola or Jew's Ear grows here and there on the hard wood of hickory and maple, Exidias are strung along the trunk and branches of all sorts of trees, and the yellow Guepinias spring out of the clefts of the wood. Here is a fertile field for the study of forms. In our aversion to "species making," it is a constant effort to refer our American species to European forms already described. So far as Hymenomycetes are concerned more mistakes have been made in this direction than in any other.

4. Schizophyllum. I have lately been catching the spores of the common Schizophyllum on a slide and trying to find them "almost globular;" but they are invariably oblong, somewhat apiculate, and on the average 5–6 × 2.5 mic. Is ours a different species or is there a mistake somewhere? Do any of our friends find specimens with the spores "subrotund?"

5. Menispora. The species of this genus are pretty Hyphos. The most common is Menispora Libertiana; in fact it is very common. Its spores are much larger and more obtuse than those of M. ciliata, which I frequently meet with also. Other species, whose spores are without the cilia, I occasionally find, such as the M. glauca and M. apicalis or something similar. M. cobaltina is very curious and rare; I have found it but once, and then it was running over old dead leaves.

6. Arthrosporium. Late in autumn and continuing through the winter until spring, the colonies of *A. compositum* Ellis are to be found on the underside of old, much decayed oak chunks; it nestles in the holes and crevices in total darkness, spreading over the surface and looking to the naked eye like a minute resupinate Hydnum. It is a pretty microscopic object, and I am always pleased to bring in a

fresh specimen and take another look at it. The spores are triseptate *fusiform*, not "filiform," as the Sylloge has it.

7. BACTRIDIUM. There seems to me to be but a single species; with moist weather it grows throughout the year: it is a very interesting object under low power; the spores are extremely large and in a drop of water tumble down like ninepins. They are most commonly 4-septate, as I observe them, with the middle cell much the largest; this corresponds to *B. clavatum* B. & Br.; 1–3-septate specimens are not uncommon, which will pass for *B. Ellisii* Berk.; rarely I bring in a specimen with abundant spores 5, 6 and even 7-septate: there seems nothing to hinder this being *B. flavum* K. & S.

8. *Næmatelia nucleata* Schw. The plant I have so referred has white, oblong curved spores 10–12 mic. in length. The European (?) plant under this name, with ovoid spores 7 mic. long, must be something different. It is very common with me on branches of sugar maple: it originates beneath the bark and shows itself in lines along the crevices.

9. *Stereum albobadium* Schw. I have lately observed that the velvety surface of the hymenium in this species is caused by hyaline fusiform bodies with a warted surface, called *metuloids;* hence it belongs in Dr. Cooke's genus Peniophora.

10. *Dacrymyces deliquescens* Bull. Bringing in some specimens, the other day, I caught the spores on a slide in great abundance, and observed that against white paper they were a pale yellow in color. They are invariably 3-septate, and my measurements of the mature spores were 14–16 × 6–7 mic., smaller than Karsten's, but about the same as Saccardo's.

Preston, Ohio.

A Revision of North American Cornaceæ. II.

JOHN M. COULTER AND WALTER H. EVANS.

---- Lower leaf-surface with only straight appressed-pubescence (except sometimes no. 14) or none.

14. **C. stolonifera** Michx. Fl. 1.92. Shrub is 1 to 3 meters high, erect or prostrate, stoloniferous, with branches usually bright red-purple and smooth: branchlets and inflorescence appressed-pubescent: petioles 6 to 36 mm. long: leaves from lanceolate to broadly ovate or oblong, short or long acuminate

or only acute, mostly obtuse at base, minutely appressed-pubescent above (or glabrate), more or less white and appressed-pubescent beneath with straight rigid hairs (sometimes becoming almost glabrate and inclined to be more or less woolly along the lower part of the midrib), 2.5 to 12.5 cm. long, 1.2 to 7 cm. wide: flowers mostly in small cymes: calyx-teeth minute: fruit white or lead-color; stones very variable, from ovate and pointed, scarcely flattened, higher than broad (5 to 6 mm. high, 3 to 4 mm. broad), to more or less flattened, broader than high (3 to 4 mm. high, 5 mm. broad), these extremes completely connected by intermediate shapes and dimensions, all with more or less furrowed edge.—*C. alba* Lam., not Linn.

Hab. From New Brunswick and New England to the District of Columbia in the Atlantic region, extending westward throughout the region of the Great Lakes, far northwest into British America along the Mackenzie river, and southward throughout the western mountain systems to New Mexico, Arizona, and N. California.

Specimens examined: Prince Edward's Island (*Macoun*): New Brunswick (*Chalmers*): Vermont (*Pringle*): Massachusetts (*Oakes*): District of Columbia (*Ward*): Pennsylvania, Erie (*Garber*): W. New York (*Gray*): Ontario (*Macoun* 526, 2241, *Mrs. Ray*): Michigan, Mackinaw, Flint (*Clarke*): N. Indiana (*Coulter*): Illinois, Peoria (*Brendel*): Wisconsin (*Douglas*): Minnesota (*L. H. Bailey* 39): Winnipeg Valley (*Bourgeau*): Mackenzie river (*Hardesty*): British Columbia (*Richardson, Macoun*): Montana (*Watson* 166, 167, *Canby, Ward*): Washington (*Suksdorf, Mrs. L. P. Anderson, G. R. Vasey*): Oregon (*Spalding, Nevius, Henderson*): California (*Bridges*), Modoc and Shasta counties (*Lemmon*), Trinity county (*C. C. Marshall*), Plumas county (*Mrs. Ames, Mrs. Austin*), Butte county (no collector cited): Nevada (*Watson* 473, *C. L. Anderson* 120): Utah, Uinta mountains and Salt Lake City (*Watson* 373): Colorado (*Hall & Harbour, Hooker & Gray, Engelmann, Wolf & Rothrock* 79, *Coulter, Jones* 125, *Patterson*): New Mexico (*Fendler* 280, *Palmer*), Ft. Wingate (*Matthews*): Arizona (*Palmer*): also from "Rocky mountains" (*Nuttall, Scoville*).

C. stolonifera, *C. Baileyi*,[1] and *C. pubescens* from a very perplexing and

[1]Since the preceding part of this paper was in print the following communication has been received from Professor L. H. Bailey, in reference to the species bearing his name: "The erection into specific rank of a very puzzling and interesting Cornus, in the February GAZETTE, calls to mind some observations which may be valuable. As a lad I was familiar with the plant upon the sand dunes of southwestern Michigan. It was early impressed upon my mind for two reasons, viz: its habit of blooming continuously all summer, and its persistence in evading all descriptions in the books. It grows often in the loosest shifting white sands, along with such things as Solidago humilis var. Gilmani, Arctostaphylos Uva-ursi, Cnicus Pitcheri, Cakile Americana, Arabis lyrata, and Cyperus Schweinitzii. In these places it often attains a height of six or eight feet, growing erect,

apparently confluent group of species. In all probability they freely cross with one another, and some of the puzzling intermediate forms may be hybrids. *C. stolonifera* extends both east and west, mingling with *C. pubescens* upon the Pacific coast, and with *C. Baileyi* about the Great Lakes, and it is in these regions that the doubtful forms occur. In typical specimens the three species can be distinguished easily by the pubescence of the lower leaf-surface. In *C. stolonifera* this pubescence is all very straight and appressed, the hairs being attached by the middle; in *C. pubescens* it is all woolly; while in *C. Baileyi* both kinds of pubescence occur on the same leaf. For this reason *C. Baileyi* has heretofore been considered *C. stolonifera*, in spite of its often abundant woolly pubescence. The pubescence thus easily separates *C. pubescens* and *C. stolonifera*, while the stone of *C. Baileyi* is very unlike that of either of the other species, whose stone characters are not so constant. The stone of *C. Baileyi* is the largest of the group, is decidedly flattened, is much broader than high, has a square-shouldered top, is not oblique, and has a prominent furrowed edge. The stone of *C. pubescens* is smaller, is less flattened, has a rounded top, is decidedly oblique, and has not generally so conspicious or furrowed an edge. Its obliqueness, together with its tendency to develop ridges on the sides, show a leaning towards *C. sericea*. The stone of *C. stolonifera* is exceedingly variable, being sometimes ovate and pointed, higher than broad, and scarcely flattened; in other cases almost identical with the stone of *C. pubescens*, but never like that of *C. Baileyi*. The specimens of *C. stolonifera* in which the stones resemble those of *C. pubescens* are mostly western, where the ranges of the two species approach each other or overlap. The stones of eastern *C. stolonifera* are more apt to have the ovate pointed form referred to above, and were it not for the fact that occasionally the most widely divergent forms of stones are to be found in a single fruit-cluster of *C. stolonifera*, a western variety might be established. In the Pacific States and British Columbia, therefore, collectors must expect to find forms fairly intermediate between *C. pubescens* and *C. stolonifera*; while about the Great Lakes they may expect the same confusion between *C. Baileyi* and *C. stolonifera*.

15. **C. candidissima** Marsh. Arbust. 35 (1785). Shrub 2.5 to 4.5 meters high, erect, with smooth mostly grayish branches:

and never possessing the stoloniferous habit of C. stolonifera so far as I am aware. The bark is much duller and browner than that of C. stolonifera. Wherever I have seen it, from near the southern extremity of Lake Michigan to the northwestern shore of Lake Superior and Hunter's Island in British America, it maintains the pearly white berries and the conspicuously tomentose leaves. It appears to possess everywhere the habit of blooming through the summer, and for this reason it may be worth cultivating. This peculiarity I recorded so long ago as 1880 in this journal (Bot. Gazette, 5, 91): 'It is worthy of note that *Cornus stolonifera* Mx. is quite common on the highest bluffs. I have seen it growing luxuriantly in drifting sand over a hundred feet above the lake, and blossoming from June till near September.'"—*Ithaca, N. Y.*

branchlets and inflorescence glabrous or nearly so: petioles 6 to 18 mm. long; leaves lanceolate to ovate, acuminate, acutish at base, minutely appressed-pubescent or glabrous on either or both sides, the lower surface from whitish to scarcely paler than the upper, 3.5 to 10 cm. long, 1.2 to 5 cm. wide: flowers in numerous loose paniculate cymes: calyx-teeth from small to prominent: anthers more or less blue along the connective (especially in the southern forms): fruit white to pale blue: stone small, nearly globular, not furrowed or very slightly so, 3 to 5 mm. in diameter.—*C. stricta* Lam. (1786). *C. paniculata* L'Her (1788). *C. fastigiata* Michx.

Hab. From New England to Florida, westward to Minnesota and Texas.

Specimens examined: Vermont (*Pringle*); Connecticut (*Eaton*); Pennsylvania (*Bridges, Martindale*); New York (*Gray*); Ontario (*Macoun* 530, 766); Michigan (*Pitcher*); Illinois (*Bebb, Wolf, Babcock, Brendel*); Wisconsin (*Mrs. Luce*); Minnesota (*Upham*); Maryland (*J. D. Smith, Sheldon*); South Carolina (*Ravenel, Gibbs*); Florida (*Curtiss* 1058, *Canby, Palmer, J. D. Smith*); Georgia (*Boykin, Rugel, Miss Reynolds*); Louisiana (*Hale, Peck*); Texas (*Hall* 265).

This species is widely distributed and replaces *C. stolonifera* in the southern states. It seemes impossible to discover any characters that will serve to break it up into varieties, much less into two species as formly considered. There is the greatest possible intermingling of the characters that were formerly considered to distinguish *C. paniculata* from *C. stricta*, and large series of specimens show that no such dividing line exists. The species is most nearly related to *C. stolonifera*, and where the ranges of the two overlap doubtful forms frequently occur. *C. candidissima* differs from *C. stolonifera*, however, in its erect habit and grayish branches, its frequently glabrous leaves, its abundant loose paniculate cymes, its frequently blue-tinged anthers, its thin-fleshed fruit, and its small globular stones.

16. **C. glabrata** Benth. Bot. Sulph. 18. Shrub 1.5 to 3.5 meters high, with erect and mostly bushy gray smooth branches bearing usually crowded small leaves: branchlets and inflorescence glabrous or nearly so: petioles short and slender (12 mm. or less long); leaves lanceolate to nearly ovate or oblong, acute at each end (or somewhat acuminate), glabrous or sparsely and minutely appressed-pubescent on both sides, the lower surface but little paler than the upper, 1.2 to 5 cm. long, 9 to 25 mm. wide: flowers in numerous small open cymes: calyx-teeth prominent: anthers inclined to be blue along the con-

nective: fruit white to light blue: stone but little compressed, not furrowed, broader than high (3 to 4 mm. high, 4 to 5 mm. broad).

Hab. In the coast ranges from the southern border of Oregon into California as far south as the Salinas valley.

Specimens examined: Oregon, Josephine county (*Howell*); California, "Coast Range" (*Hartweg* 1762, *Bolander* 127), Siskiyou county (*Greene* 875), Butte county (*Parry* 777, *Mrs. Bidwell*), Napa county (*Bolander* 2657), Sacramento county, on the Consumnes river (*Rattan*), Salinas river (*Brewer* 566, *G. R. Vasey* 235).

This restricted species is most nearly related to the eastern *C. candidissima*, but differs decidedly in its stone characters. It is most apt to be confused with Californian forms of *C. stolonifera*, and forms occur which seem intermediate between the two. In such intermediate forms the leaves are apt to become broader than in *C. glabrata*, more strongly appressed-pubescent, whiter beneath, the branches incline more to be reddish, and the stone becomes flatter and more or less furrowed, and even as high as broad or slightly higher, intergrading plainly with the leaves and variable stone of *C. stolonifera*. Such forms we must be content at present to consider as intermediate (possibly hybrids), and collectors must not expect every specimen to be strictly one or the other species. Typical *C. glabrata* can always be recognized by its bushy habit, gray branches, and small crowded nearly glabrous leaves which are about the same color on both sides. We would cite as intermediate forms: *Pringle* 306, from Summit valley, California, which is completely glabrous, but the leaves are whitish beneath and the stone has often the flattened furrowed form of western *C. stolonifera* or *C. pubescens*, but showing the variability of the former species; *Parry* 777 in part, from Chico, which is like the Pringle specimen except that the leaves are decidedly appressed-pubescent beneath. *Greene* 875, from Siskyou county, referred above to the type, differs from it in the decidedly whitish lower leaf-surfaces, and in the fact that the stones vary from broader than high to slightly higher than broad.

++ Leaves alternate and clustered at the ends of branchlets.

17. **C. alternifolia** Linn. f. Suppl. 125. Shrub or tree 2.5 to 8 meters high, with widely spreading alternate green branches: petioles slender, 2 to 3.5 cm. long: leaves oval or ovate, mostly long acuminate, obtuse or acute at base, glabrous or sparsely pubescent above, whitish and appressed-pubescent beneath, 5 to 10 cm. long, 3 to 6 cm. wide: flowers in broad open pubescent cymes: calyx-teeth minute: fruit deep blue on reddish stalks: stone obovoid, longitudinally furrowed (5 to 6 mm. high, 4 to 5 mm. broad).

Hab. In rich woods and along borders of streams and swamps, from New Brunswick and Nova Scotia to the west side of Lake Superior, southward throughout the Northern States and along the Alleghanies to N. Alabama and N. Georgia.

Specimens examined: Maine (*Redfield*); Vermont (*Pringle*); Connecticut (*Eaton, Bishop*); Long Island (*Young*); Maryland (*J. D. Smith*); Pennsylvania (*Martindale*); New York (*Gray, Clinton*); Ontario (*Macoun* 772); Michigan (*Clarke*); Indiana (*Thomson, Evans*); Illinois (*Wolf, Brendel, Hovey*); Iowa (no collector given); Wisconsin (*Douglas, Mrs. Lucc*); N. Georgia (*G. R. Vasey*).

2. NYSSA Linn. Gen. n. 1163. The older systematists described a good many more species of *Nyssa* than can now be allowed since more material has been accumulated. The species are naturally grouped into those with small fruits and those with large fruits, while the stone characters are absolutely definite as to species. An interesting gradation in stone characters is to be noted. In *N. aquatica* the low, broad ridges of the terete stone are hardly more than outlined: in *N. biflora* the stone is flattened, and the ridges become rounded and prominent, giving a furrowed appearance to the thin-fleshed fruit; in *N. uniflora* the ridges are acute and prominent, separated by broad rounded depressions; in *N. Ogeche* the ridges are sharp as in the last, but are also extended into conspicuous membranaceous wings.

* Fruit small (8 to 13 mm. long): stone with low broad rounded ridges more or less distinct.

1. **N. aquatica** Linn. Spec. 1058 (restricted). A tree becoming 15 to 36 meters high, or much smaller at the north: leaves from linear-oblong or lanceolate to oval or obovate, acute or acuminate, entire, smooth and shining (when old) above, more or less hairy along the veins beneath, or almost woolly when young, 5 to 17.5 cm. long, 1.8 to 8.5 cm. wide: staminate flowers numerous in loose or somewhat dense clusters: pistillate flowers 2 to 14, at the summit of a more or less elongated peduncle, mostly developing 1 to 3 fruits: fruit ovoid, acid, bluish-black, 8 to 13 mm. long: stone ovoid, slightly flattened or not at all, smooth or scarcely ridged, 7 to 10 mm. high, 5 to 8 mm. broad. *N. sylvatica* Marsh. *N. multiflora* Wang. *N. villosa* Michx. *N. multiflora*, var. *sylvatica* Watson.

Hab. From S. Maine to Ontario and Michigan, southward to Florida and Texas.

Specimens examined: Rhode Island (no collector given); Connecticut (*Wright, Eaton*); New York (*Darby, Edgerton*); New Jersey (*Martindale*); Pennsylvania (*Hoopes, Martindale*); Ontario (*Macoun* 103); Ohio (*Riddell*); Indiana (*Coulter*); Michigan (*Pitcher, Clarke*); Maryland (*J. D. Smith*); District of Columbia (*Vasey, Ward*); Virginia (*A. H. Curtiss*); North Carolina (*Gray, A. H. Curtiss, J. D. Smith*); South Carolina (*M. A. Curtiss, Ravenel*); Georgia (*Olney & Metcalf* 269); Florida (*Chapman, Curtiss* 1061, *Garber*); Tennessee (*Fendler*); Arkansas (*Fendler*); Texas (*Hall* 267).

The original *N. aquatica* of Linnæus contained also *N. uniflora*, but that occupies a subordinate place in his description. It seems proper, in breaking up the original Linnæan description to retain his name for that species which was evidently most prominent in his mind.

2. **N. biflora** Walter. 253. Resembling the last, but leaves smaller, 2.5 to 7.5 cm. long, 1.2 to 3.5 cm. wide, acute or obtuse: pistillate flowers 1 to 3 (commonly 2): stone decidedly flattened and prominently and obtusely ridged, making a longitudinally furrowed fruit. *N. Caroliniana* Poiret. *N. aquatica* Chapman, not L.

Hab. From New Jersey to Florida, and westward to Tennessee and Alabama.

Specimens examined: New Jersey (*Torrey*); Delaware (*Canby*); South Carolina (*Mellichamp, J. D. Smith*); Georgia (*A. H. Curtiss* 1062); Florida (*Chapman, Rugel, J. D. Smith*); Alabama (*Watson, Mohr, G. R. Vasey*); Tennessee (*Gattinger*).

This species is very closely allied to *N. aquatica*, but the usually smaller leaves, fewer pistillate flowers, and flattened conspicuously ridged stone and fruit are more definite and constant characters than are used to separate many species of *Cornaceæ*.

* * Fruit large (16 to 36 mm. long); stone with very prominent acute or winged ridges.

3. **N. uniflora** Wangenh. Amer. 83. A large tree 18 to 30 meters high: leaves long-petioled, ovate or oblong, mostly obtuse or even cordate at base, acute or acuminate, entire or angulate-toothed, becoming smooth above, pale and downy pubescent beneath (especially when young), 7.5 to 25 cm. long, 3.5 to 12.5 cm. wide: staminate flowers numerous in rather dense clusters: pistillate flowers solitary on slender elongated peduncles: fruit olive-shaped, becoming dark-blue, 16 to 30 mm. long: stone narrowly obovate, flattened and with prominent acute almost winged ridges, as high as the fruit and 8 to 12 mm. broad.—*N. aquatica* L. in part. *N. denticulata* Ait. *N. angulosa* Poir. *N. tomentosa* Michx. *N. angulisans* Michx. *N. grandidentata* Michx. f.

Hab. S. Virginia to Florida, westward through the Gulf States to Texas, thence northward through Arkansas, Missouri and Tennessee to the Lower Wabash in S. Illinois.

Specimens examined: Virginia (*L. F. Ward*); South Carolina (*Ravenel, Mellichamp*); Georgia (*Curtiss* 1863); Florida (*Chapman, Rugel*); Alabama *Mohr., J. D. Smith*); Tennessee (*J. D. Smith*).

The fruit is commonly called "wild olive."

4. **N. Ogeche** Marshall, Arbustum 97 (1785). A tree 9 to 18 meters high: leaves thickish, short-petioled, oblong, oval, or obovate, mostly obtuse (sometimes retuse) and mucronate, entire, becoming smooth above, more or less (usually rusty) pubescent beneath, 6 to 13.5 cm. long, 3.5 to 7.5 cm. wide: staminate flowers in capitate clusters: fertile flowers perfect, solitary, on very short peduncles: fruit olive-shaped, very acid, red, 24 to 36 mm. long: stone oblong, somewhat flattened, as long as the fruit and 10 to 14 mm. broad, the acute longitudinal ridges extended into about 12 conspicuous membranous wings.—*N. capitata* Walter (1788). *N. coccinea* Bartram. *N. tomentosa* Poir. *N. candicans* Michx.

Hab. In swampy ground from the southern border of South Carolina, southward through the Ogeechee valley of Georgia to northern (Clay county) and western (Washington county) Florida.

Specimens examined: South Carolina, Bluffton (*Mellichamp*); Georgia, Ogeechee river (*Darby, Curtiss* 1064); Florida (*Chapman*); Hibernia (*Canby*).

This species has been said to occur in Arkansas, but the specimens that we have seen so labeled are large-leaved forms of N. aquatica; and the fruit is not at all that of N. Ogeche. The very acid fruits of this species are called "wild limes."

3. GARRYA Dougl. in Lindl. Bot. Reg. t. 1686.—This peculiar southwestern and Mexican genus seems to bear no resemblance to our two other genera of *Cornaceæ*. The staminate and fertile flower-clusters are more or less amentaceous, though sometimes they do not seem to be true aments. For convenience, however, we will use the term "ament" for the flower cluster, meaning simply a narrow more or less elongated bracteate cluster. The fruit is usually called a "berry," presumably because it generally contains two stones, but otherwise it corresponds very well with the drupes of other *Cornaceæ*.

* Fertile aments with distant flowers and more or less foliaceous bracts.

1. **G. ovata** Benth. Pl. Hartw. 14. A shrub ½ to 2 meters

high, with branchlets and inflorescence more or less silky-pubescent: petioles 6 to 16 mm. long: leaves narrowly lanceolate to ovate, mostly acute and mucronate (sometimes obtuse), entire, clothed on both surfaces with a silky pubescence (or glabrate above), 2.5 to 6 cm. long, 1.2 to 3.5 cm. wide, with thickened muriculate margins: sterile aments with small connate bracts: fertile aments 2.5 to 7.5 cm. long, with somewhat distant flowers in the axis of bracts which are usually foliaceous and distinct: fruit globose to ovoid, becoming glabrous, sessile or short-pedicellate, 4 to 8 mm. in diameter.

Hab. W. Texas, and abundant southward in the mountains of Mexico.

Specimens examined: Guadalupe mountains, W. Texas (*Havard*).

We have examined an abundance of material of this common and variable Mexican species, and are satisfied that it is represented in our flora by the Texas specimens of Dr. Havard, which have narrow leaves and small ovoid fruits. To this must also be referred *Pringle* 131 (coll. of 1885), from Santa Eulalia Mountains, Mexico, distributed as *G. Lindheimeri* ?, in which the leaves are inclined to have undulate margins. This last form passes by intermediate gradations to

Var. **Lindheimeri.** Branchlets and both leaf-surfaces more or less clothed with kinky wool (or the upper leaf-surface glabrate with age): leaves oblong or obovate, mostly obtuse and mucronate, often a little larger and broader, and the margins not thickened and muriculate.—*G. Lindheimeri* Torr.

Hab. From Texas to Arizona, and extending into Mexico.

Specimens examined: Texas (*Lindheimer* 27, 512, 536), Austin (*Buckley*), Mountains of Kimble county (*Reverchon* 90), Rio Blanco (*Sargent*), Gillespie county (*Jermy*): W. Texas and N. Mexico (*Wright* 633).

Dr. Torrey's description was based upon Wright's sterile specimens. All the other collections examined have mature fruit. This variety is easily recognized by its remarkable kinky wool, occuring especially upon the lower leaf-surfaces and branchlets, but often also upon the upper leaf-surfaces. The bracts show great variation, the foliaceous forms being confined chiefly to the fertile aments.

2. **G. Wrightii** Torr. Pacif. R. Rep. 4. 136. Shrub ½ to 1 meter high, becoming glabrate: petioles 4 to 10 mm. long: leaves light green (drying bluish), oblong-lanceolate to elliptical or obovate, acute at each end, mostly mucronate, with thickish slightly muriculate margins, glabrous or nearly so on both sides, 1.8 to 5 cm. long, 1.2 to 3 cm. wide: aments more or less branching and distant-flowered: sterile aments

with smaller but distinct bracts; fertile aments 3.5 to 8.5 cm. long; upper bracts rather small (apt to be connate at base), becoming more foliaceous and distinct downward, until the lowest resemble the ordinary leaves (giving the appearance of sessile axillary flowers): fruit globose, becoming glabrous, sessile, 4 to 7 mm. in diameter.

Hab. From the counties of W. Texas, New Mexico and Arizona, adjoining Mexico, and southward into the mountains of Chihuahua.

Specimens examined: W. Texas, Presidio and El Paso counties (*Havard*); New Mexico (*Wright* 634, 1789), on the Rio Grande, Dona Ana county (*Mex. Bound. Surv.* 1637), Grant county (*Rusby* 253½); Arizona, Graham county (*Lemmon*), Pinal county (*Greene*), Pima and Cochise counties (*G. R. Vasey*), Santa Catalina mountains (*Pringle* of 1881).

* * Fertile aments densely flowered and with small scarious bracts.

3. **G. Fremontii** Torr. Pacif. R. Rep. 4. 136. Shrub 1.5 to 3 meters high, becoming glabrous: petioles 6 to 18 mm. long; leaves light green, ovate to oblong or elliptical (sometimes obovate), mostly acute at each end (sometimes obtuse at apex), usually somewhat mucronate, entire, smooth or nearly so on both sides, 2.5 to 7.5 cm. long, 1.2 to 3.5 cm. wide: fertile aments 5 to 11 cm. long; bracts prominent, connate above the middle, acute, somewhat silky: fruit globose, becoming glabrous, short-pedicellate, 4 to 6 mm. in diameter.

Hab. From S. Oregon (Umpqua mountains) southward into California to the Yosemite valley and Mt. Hamilton.

Specimens examined: Oregon, Umpqua mountains (*Wilkes' Exped.* 1183), Canyonville (*Howell*), "Cascade Mountains" (*Cusick*); California (*Bolander, Kellogg and Harford* 926, 927), Siskiyou county (*Greene* 953), Upper Sacramento (*Fremont's Exped.* 369), Plumas county (*Mrs. Austin*), "Sierra Nevada" (*Lemmon*), Mendocino county (*G. R. Vasey*), Lake county (*Bigerstaff*), Placer county (*Jones* 92), Yosemite valley (*Hooker & Gray, Canby*), Mt. Hamilton (*Brewer* 1305).

This species is apt to be confused with *G. flavescens*, but its glabrous branches and leaves, and glabrous pedicellate fruit should distinguish it. The bracts of both species are connate, but those of *G. Fremontii* are more apt to be connate almost to the tips.

4. **G. Veatchii** Kellogg, Proc. Calif. Acad. 5. 40. Spreading shrub, 1.8 to 2.5 meters high: branchlets pubescent with close appressed silky hairs: petioles short, 2 to 6 mm. long; leaves coriaceous, elliptic-ovate to -oblong (or sometimes almost obovate), acute at each end, mucronate, entire, glabrous or nearly so above, densely tomentose beneath, 2.5 to 7.5 cm.

long, 1.8 to 3.5 cm. wide: fertile aments 2.5 to 5 cm. long; bracts prominent, connate, acute or acuminate, silky: fruit somewhat ovate, densely silky or becoming glabrate, sessile, 6 to 8 mm. long.—*G. flavescens*, var. *Palmeri* Watson.

Hab. In the coast counties from Santa Barbara southward into Lower California and Cedros Island.

Specimens examined: Cedros Island (*Dr. Veatch*); Lower California (*Orcutt* 900); California, San Diego county (*Palmer* 117, 118), Los Angeles county (*O. D. Allen* 22), Santa Barbara county (*H. C. Ford*).

Var. **flavescens.** Leaves not so tomentose beneath, but alike silky on both sides (or becoming smoother above), 2.5 to 5 cm. long, 1.8 to 2.5 cm. wide, scarcely mucronate, on longer petioles (6 to 12 mm. long): fruit 6 to 8 mm. long.—*G. flavescens* Watson.

Hab. From S. Nevada and Utah to Arizona and New Mexico.

Specimens examined: S. Utah, Washington county (*Palmer* 183½), Kane county, Kanab (*Mrs. A. P. Thompson*); Arizona (*Capt. C. A. Curtis*).

5. **G. buxifolia** Gray, Proc. Am. Acad. 7. 349. A small shrub ½ to 1½ meters high: petioles, 2 to 7 mm. long; leaves oblong-elliptical (sometimes almost round), acute at each end (sometimes obtuse at base), entire, becoming smooth and shining above, densely white silky beneath, 1.8 to 4 cm. long, 8 to 24 mm. wide: fertile aments 2.5 to 3.5 cm. long; the bracts short, acute, more or less silky: fruit globose, becoming glabrous, nearly sessile, 5 to 6 mm. in diameter.

Hab. Red Mountains, Mendocino county, California.

Specimens examined: From the original station (*Bolander* 6579, *Kellogg & Harford* 928).

6. **G. elliptica** Dougl. in Lindl. Bot. Reg. t. 1686. A stout shrub or small tree 1.5 to 2.5 meters high: petioles 6 to 12 mm. long; leaves elliptical, rounded at base, round or acute and mucronate at apex, undulate on the margin (whose infolding often gives a toothed appearance), smooth above, densely tomentose beneath, 3.5 to 10 cm. long, 1.8 to 5.5 cm. wide: aments solitary or clustered; sterile aments 5 to 30 cm. long, the bracts truncate or acute, silky; fertile aments stouter, 2.5 to 8.5 cm. long, with acute or acuminate bracts: fruit globose, densely silky-tomentose, sessile, 6 to 9 mm. in diameter.

Hab. Near the coast, from Monterey, California, to the Columbia river.

Specimens examined: California (*Thos. Coulter* 647, *Hartweg* 1935, *Kellogg & Harford* 928, *Brewer* 1564), San Francisco Bay (*Wilkes' Exped.* 1490), Berkely (*Greene*); Oregon, Curry county, Chetco (*Howell*), "Columbia and southward" (*Douglas*).

Crawfordsville, Ind.

BRIEFER ARTICLES.

Glandular pubescence in Aster patens.—While studying the involucral bracts of some of our Asters I found a specimen of A. patens which differed from the description in that the bracts of the involucre were apparently glandular pubescent. This led to a further examination of this species and incidentally others that were described as being glandular pubescent.

The earlier authors, in their descriptions of Asters, do not mention glandular hairs, even when they are so evident as in the very common A. Novæ-Angliæ. I have not been able to find any description of A. patens in which it is credited with glandular pubescence. Aiton, who first described it (Hort. Kew.), followed by Pursh and Michaux (A. amplexicaulis), does not speak of any kind of pubescence on the bracts. Elliott (A. undulatus) says, "involucre pubescent;" Darlington (Fl. Cest.), "involucre minutely scabrous;" Nees (Ast.), "periclinii * * foliolis * * scabris;" Torrey (Nat. His. N. Y.), "scales minutely pubescent or hairy and somewhat granulate." It is described by other authors in about the same way.

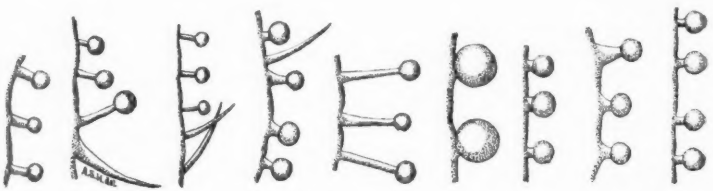
In the case of *A. patens* Ait. var. *phlogifolius* Nees, I find no mention of glandular pubescence except under *A. auritus* (Lindl. in DC. Prod.) which Dr. Gray refers to this variety. It is described, " * * * involucri parum imbricati, squamis linearibus acuminatis ramulusque glandulosis."

In the latest revision of our Asters (Gray, Syn. Fl.) several species are described as being glandular. Subsection 2, of Aster proper—Glandulosi—consisting of eight species, is set off by, "Involucre and usually branchlets viscidly or pruinose-glandular * * * *." Among the characters of subsection 6—Patentes—consisting of *A. patens* Ait. with two varieties, *gracilis* Hook. and *phlogifolius* Nees, is "bracts * * * minutely granulose or scabrous, but not glandular." In order to guard against mistakes, it is remarked in parenthesis, under Glandulosi, "Glandular involucre also in species of § Machæranthera," and in connection with A pauciflorus, "involucre * * * viscid-glandular * * * might be sought among the Glandulosi of true Aster." Glandular pubescence occurs in several other species, but in none is it a prominent character. But the finding of glandular hairs in A. patens might be misleading to a student.

In order to determine to what extent this kind of pubescence occurred in Patentes, all the specimens available were examined. In those from St. Louis the bracts are to the naked eye somewhat silky pubescent; under the microscope they are densely appressed villous, in some cases showing only here and there a gland tipped hair, in others being quite glandular. But in all the other specimens, representing La., Tex., S. C. and Pa., the glandular hairs are numerous and distinct, while the pointed hairs are fewer, thus causing the involucre to appear to the naked eye or under a low power lens as "granulose"or "minutely scabrous."

Specimens of A. patens var. gracilis (Texas, Lindheimer) and var. phlogifolius (Ky., Short) show the glandular pubescence very distinctly, as do specimens of the same from other localities.

In size, shape and general appearance the glandular hairs are very similar to those of *A. oblongifolius* Nutt. The pedicels are one to three times as long as the glands, rather slender and not much widened at the base; the glands are yellow, more or less roughened and viscid, as shown by the adherence of particles of dirt. The whole hair is about half as long as the intermixed pointed ones. They are more numerous towards the tip and margin of the bract, and were observed only sparingly on the pedicels.



GLANDULAR HAIRS OF ASTERS. x 66.

1. A. patens Ait.; 2. A. patens Ait., var. phlogifolius Nees.; 3. A. patens Ait., var. gracilis Hook.; 4. A. oblongifolius Nutt.; 5. A. gymnocephalus Gray; 6. A. tanacetifolius H. B. K.; 7. A. parviflorus Gray; 8. A. grandiflorus L.; 9. A. Novæ-Angliæ L. (from Iowa).

The accompanying drawings were made from heads obtained, through the kindness of Dr. Watson, from specimens at Cambridge, named by Dr. Gray.—A. A. HITCHCOCK, *Missouri Botanical Garden, St. Louis.*

EDITORIAL.

THE RECENT annual report of the president of Harvard University contains some information that should be in the possession of American botanists. The impression that Harvard University is exceedingly well endowed may be true enough in general, but it is very far from being true of the Herbarium. We have the somewhat anomalous case of the most famous herbarium in America, for many years under the direct care of the most distinguished botanist in America, and in the possession of the oldest and nearly the wealthiest university of America, living, last year, on a beggarly income of $3,300, out of which the curator is paid, the collection increased and kept in order, and the library kept up with the times! The final touch to this showing is that $2,200 of this amount was derived from the gifts of Dr. Gray himself, copyrights which he had bequeathed to the herbarium. To an outsider it looks as if the university was making a rare bargain in devoting $1,100 of its own income to the maintenance of so famous an establishment as the Gray herbarium and library. Many a college in this country would be willing to give ten times that amount annually for the support of an institution which wields such an influence over American botany. American botanists have no sympathy with the corporation of Harvard University in this matter, but they do have a lasting pride in the great collection of plants it possesses, and a still stronger love for the memory of him who made it what it is. For this reason they should be ready to use their influence towards securing a proper endowment. If endowment for botanical research is a desirable thing, the endowment of the Gray Herbarium will secure the largest amount of botanical work for the least outlay of money. It requires a vast amount of money to found such an establishment, even were such a thing possible, but it does not require very much to make such an establishment productive when it is already founded.

The speedy completion of the Synoptical Flora is about the most ardent desire of American botanists, and the man who must direct its completion is Dr. Sereno Watson. But how can he even hope to accomplish so vast an undertaking with his hands tied by the drudgery of a great collection? It is astonishing that he can do any monograph work. There is need of ample assistance in caring for the plants; and there is further need of associating with Dr. Watson a corps of investigators. Only in this way can we hope for any prompt completion of the Synoptical Flora. It has occurred to us that if American botanists bestir themselves the required endowment can be easily secured.

CURRENT LITERATURE.

Flora of the Kurile Islands.

MR. K. MIYABE has published a list of the flora of the Kurile Islands as one of the memoirs of the Boston Society of Natural History. These are the "thousand isles" of Japan, extending in a chain about 795 miles long, from the southern point of Kamtschatka to the island of Yezo. They are hard to approach on account of fogs and poor harbors, and hence very little has been known of their botanical features. The few plants known have been mostly collected by Russian naval officers, and most of the material is in the St. Petersburg herbarium. Mr. Miyabe, in 1884, had an opportunity of visiting these little-known islands and made a collection of plants. While a student at Harvard University Dr. Gray suggested to him the publication of as complete a list as possible of the plants of the Kurile Islands, as it would be equally interesting to American and Japanese botanists. With the aid to be obtained at Cambridge, and assistance from Prof. C. J. Maximowicz, Mr. Miyabe has prepared an exceedingly careful and interesting paper. The physical geography of the islands is described, but interest centers about the discussion of the characters of the Kurile flora and its relations to the flora of neighboring countries. Out of a total of 317 known species of Phanerogams and Pteridophytes, 121 are Polypetalæ, 100 are Gamopetalæ, 19 are Apetalæ, 53 are Monocotyledons, 6 are Gymnosperms, and 18 are Pteridophytes, the chief orders being Compositæ (30 species), Rosaceæ (23), Gramineæ (17), Ericaceæ (16), etc. As a general statement the Kurile flora may be said to be relatively rich in Rosaceæ, Ericaceæ, Caryophyllaceæ, Scrophulariaceæ, Caprifoliaceæ and Borraginaceæ; while in Cyperaceæ, Labiatæ and Polygonaceæ it is comparatively poor. There are only two endemic species, a Draba and an Oxytropis, and both of these seem to be of doubtful character. The largest and most important element is the "Northeastern Asiatic," whose center of distribution is to be found somewhere around the Sea of Okhotsk. The next largest is the "Eastern Asiatic." "Of the species which extend into Europe there are 55; and into North America 80. Of these 80 species, 34 are limited to northwestern America, which includes Alaska and British Columbia; while 22 extend further southward on the Rocky Mountains and other high ranges in the Pacific states. The remaining 24 species are all widely distributed across that continent, chiefly in its cool temperate region. In the Kuriles we have no species which are limited to the Atlantic states in North America." The whole memoir is full of interest to the student of geographical botany, as well as being a model presentation of a small but important flora.

Minor Notices.

A PORTFOLIO, larger or smaller, in which the flowering tops of a few plants are precisely, or often fantastically, arranged, seems to be the ideal "herbarium" of the high school and too often of the college teacher of botany. Such an ideal will be fully met by the handsome 7 by 9 portfolio designed by Professor Nelson.[1] It contains 50 folded sheets of thin paper of the size named. The first page of each is intended for a description of the plant, which is to be mounted on the third. Our objections to the design are fundamental. It gives to a student a wholly wrong notion of what a herbarium is, of what it is for, and of how it ought to be prepared. Any student who wishes to form a *real* herbarium will have to have these notions eradicated, and for one who does not, making such a "play" herbarium is worse than useless, since it gives him to think that he has done something right when he has done it wrong.

MR. F. H. KNOWLTON of the National Museum has published a paper on the fossil wood and lignite of the Potomac formation.[2] The specimens discussed occur in the neighborhood of Washington and Baltimore, in pockets of hard bluish clay. The lignite is more abundant than the silicified wood, and is jet black in color. Sections were rendered transparent by macerating pieces for a week in carbonate of potash, cutting thin sections with a razor and heating these in a watch glass with strong nitric acid until they become yellow, when they were dropped into cold water and afterward mounted in glycerine. Five new species are described with illustrations. The paper is preceded by an important resume of the previous writings on fossil woods.

NOTES AND NEWS.

THE BRITISH MUSEUM has purchased the largest part of the collection of mounted slides left by the late Dr. DeBary.

DR. JULIUS ROLL shows in a recent paper on the *Botanisches Centralblatt* (xli. 241) that the stem leaves of Sphagna, which have been relied on as one of the most constant specific characters of this group, are subject to extensive variation.

DR. C. WARNSTORF, of Neuruppin, has just issued the second Century of European Sphagnaceæ. As he is well known as an authority on the numerous and difficult forms of this exceedingly variable genus the specimens will be of decided critical value. Of the commoner species a large number of forms are issued.

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[1] NELSON, EDWARD T.—Herbarium and plant descriptions. Boston: Allyn & Bacon. 75 cents.

[2] KNOWLTON, FRANK HALL.—Fossil wood and lignite of the Potomac formation. (Bulletin 56, U. S. G. S.) pp. 72. pl. 7. 8vo. Washington: Gov. Printing Office. 1889.

MR. W. THOMSON has described a bed of leaves still retaining a distinct green color, found at a depth of twenty-one feet below the surface when digging for the Manchester ship-canal, which must have lain in the same position certainly for some centuries. Dr. E. Schunck has determined this coloring matter to be modified chlorophyll resulting from the action of acids on true chlorophyll.—*Jour. Roy. Mic. Soc.*

ONE OF THE specially commendable features of the *Revue général de Botanique* is the readable résumés of the progress of knowledge of different groups of plants. In the numbers for January and February such a résumé of the work on Algæ, published in 1888 and part of 1889, is contributed by M. Flahault. These articles are of use, probably, to specialists, but they are of great use certainly to those who wish to keep informed of the progress of botany in general.

DRS. FRANK AND TSCHIRCH have in preparation a series of wall charts especially for the illustration of physiological lectures. The charts are of the same size as the well known ones of Kny (69 × 85 cm.), and are issued by the same firm (Paul Parey, Berlin). The first ten have been issued, and the explanatory text sent out with them indicates that they will prove exceedingly useful for the lecture room and laboratory. The low price (M. 30) puts them in reach of every college in which plant physiology receives the least attention.

DR. J. KUNDIG, docent at the University of Zürich, has devised an apparatus for illustrating on a large scale the growth of the upper internodes of a stem. It consists of a mechanism actuated by a crank handle which causes a series of telescoping brass tubes to extend in such fashion that each tube, representing an internode, moves upward at the same relative rate that internodes grow. As an optical demonstration of the mode of the extension of stems and of the "grand period" of each internode, the apparatus would be exceedingly useful in lectures.

AN APPARATUS for observing very small amounts of transpiration is figured in the January number of the *Revue général de Botanique*. It was devised by Mr. G. Curtel for the study of transpiration during the Norwegian nights. It consists of a large U-tube, into the left arm of which is fixed the plant under observation by means of a rubber cork and soft wax; into the right arm is fixed a graduated capillary tube, bent just above the cork so as to be horizontal when the U-tube is upright. The whole apparatus is filled with water. Readings are taken of the rate at which the end of the water column travels along the graduated tube, together with the other data desired.

THE VARIATION in the behavior of different trees when girdled is well known. Dr. Hartig, in a recent address at a meeting of the Munich Botanical Society, presented his explanation of the phenomena. Those trees in which the conduction of water is almost wholly carried on by the sap wood are able to withstand girdling but a short time, since the progressive formation of heart wood and the drying of the exposed wood on the outside soon cut off the water supply to the parts above. Those trees that employ the heart wood in the conduction of water are able to live for a number of years after girdling. A tree growing in close association with others of the same species often withstands such injury for a much longer time than one isolated from its fellows. This is ascribed to the nourishment of the roots from those of the other trees. Whether the tree forms annually new absorbing roots or is able to absorb by means of the older roots, will also affect its power to resist death from girdling.